

What is claimed is:

1. A needleless hypodermic injection device for delivering liquid medication contained therein, the device comprising pyrotechnical means for generating within the device a pressure necessary for injecting the medication, and ignition means for igniting a propellant contained in the device, the primer device being part of the ignition means, and comprising a primer material which is adapted to be ignited by friction of the primer material with a mechanical frictional element.
2. The device according to claim 1, wherein the frictional element is an elongated rod, a portion of which is embedded in the primer material, the outer surface of the portion having serrations that cause frictional forces when the rod portion is pulled out of the primer material.
3. The device according to claim 1, wherein the primer device is a stab primer device.
4. The device according to claim 3, wherein the entire amount of propellant in the device is located within the stab primer device.
5. The device according to claim 3, which further comprises an amount of propellant located outside of the stab primer device.
6. The device according to claim 3, wherein the stab primer device contains a firing pin and a bistable spring for driving the firing pin so that it penetrates a primer material contained in the stab primer device.
7. A needleless hypodermic injection device for delivering liquid medication contained therein, the device comprising pyrotechnical means for generating within the device a pressure necessary for injecting the medication, ignition means for igniting a propellant contained in the device, the ignition means comprising
a stab primer device and a firing pin for penetrating a stab primer material stationarily arranged within the stab primer device, the stab primer material being so positioned with respect to the propellant that when the firing pin penetrates the primer

material hot products of combustion of the primer material are generated and these products ignite the propellant.

8. The device according to claim 7, which further comprises
a spring for urging the firing pin towards the primer material, and
a release latch for holding the spring in a loaded position and thereby the firing pin in a cocked position and for releasing the spring and thereby drive the firing pin towards the primer material.
9. The device according to claim 7, wherein the stab primer device comprises a stab primer open on two sides opposite to each other.
10. A needleless hypodermic injection device for delivering liquid medication contained in the device, the device comprising pyrotechnical means for generating within the device a pressure necessary for injecting the medication, and ignition means for igniting a propellant contained in the device, the ignition means comprising
a slidably mounted stab primer device which is open on only one side, the open side being arranged in face of a sharp point of a stationary stab pin,
an impact plunger for driving the stab primer device towards the stab pin so that that pin penetrates into a primer material contained in the stab primer device,
a spring for urging the plunger towards the primer material, and
a release latch for releasably holding the spring and thereby the plunger in a cocked position.
11. The device according to claim 10, which further comprises release means for releasing the release latch.
12. The device according to claim 10, wherein the release means comprises a breakable crimp joint or a breakable rod.
13. The device according to claim 10, wherein the impact plunger comprises a tapered section and a hook for setting the plunger in a cocked position, and wherein the release latch

is a release lever for releasing the hook and for thereby releasing the impact plunger from the cocked position.

14. The device according to claim 7, wherein the firing pin ends in a firing pin head located within a closed chamber which seals a space of limited volume located between the firing pin head and one side of the stab primer.

15. The device according to claim 7, which further comprises
a spring for urging the firing pin towards the primer material, and
a release mechanism for holding the spring in a loaded position and thereby the firing pin in a cocked position and for releasing the spring and thereby drive the firing pin towards the primer material.

16. The device according to claim 15, wherein the firing pin, the spring and the release mechanism being located in a closed space into which hot gases generated by ignition of the primer material and the propellant flow.

17. The device according to claim 15, wherein the release mechanism comprises means for rotating the firing pin by means of a torque applied by means located outside the device, the rotating bringing the firing pin from a first angular position where it is in a cocked position to a second angular position where the pin is free to move axially and making contact with the primer material.

18. The device according to claim 15, wherein the release mechanism comprises a shaft adapted to be twisted from a first angular position to a second angular position for releasing the spring, the shaft being in contact with the firing pin in the cocked position thereof, but being mechanically disconnected therefrom so that when the firing pin is released from its cocked position and moves towards the primer material, the shaft does not move with the firing pin.

19. The device according to claim 18, wherein the shaft includes flange means which seals an annular opening around the shaft when pressure pushes the shaft to the rear of the device.

20. The device according to claim 7, wherein the ignition means is an integral part of a preassembled gas generator module.
21. The device according to claim 15, wherein the ignition means is an integral part of a preassembled gas generator module.
22. The device according to claim 7, which further comprises
a bistable spring for urging the firing pin towards the primer material, the bistable spring being adapted to snap at a transition point from a first stable position to a second stable position.
23. The device according to claim 22, which further comprises an actuation screw which when turned in a predetermined position pushes the bistable spring and the firing pin towards the primer material and thereby brings the spring to the transition point where it snaps from the first to the second position, the latter snapping causing the firing pin to penetrate and ignite the primer material.
24. The device according to claim 22, wherein the bistable spring and the firing pin are integral part of the structure of the stab primer.
25. The device according to claim 22, which further comprises an actuation push pin which when axially displaced in a predetermined position pushes the bistable spring and the firing pin towards the primer material and thereby brings the spring to the transition point where it snaps from the first to the second position, the latter snapping causing the firing pin to penetrate and ignite the primer.
26. The device according to claim 22, wherein the bistable spring seals an opening of the stab primer device.
27. The device according to claim 25, which further comprises a venting passage which fluidically connects spaces on opposite sides of the bistable spring and thereby enables gas flow around the bistable spring.

28. The device according to claim 22, wherein the bistable spring has the shape of a disk.
29. The device according to claim 28, wherein the bistable spring comprises vents that equalize pressure on both sides of the disk.
30. The device according to claim 22, wherein the ignition means is an integral part of a preassembled gas generator module.
31. A needleless hypodermic injection device for delivering liquid medication contained therein, the device comprising
- (a) a cartridge which contains
 - (a.1) a medication unit containing the liquid medication,
 - (a.2) pyrotechnical means for generating within the device a pressure necessary for injecting the medication, and
 - (a.3) ignition means for igniting a propellant contained in the device, the ignition means comprising a stab primer device and a firing pin for penetrating a stab primer material stationarily arranged within the device, the stab primer material being so positioned with respect to the propellant that when the firing pin penetrates the primer material hot products of combustion of the primer material are generated and these products ignite the propellant, and
 - (b) a spring and trigger mechanism for striking the firing pin with such an impact that it strikes and penetrates the primer material, the spring and trigger mechanism being located outside the cartridge.
32. The device according to claim 31, wherein
- the firing pin is slidably arranged in a bore of a housing part of the cartridge, a portion of the inner wall of the bore having ratchet fingers,
 - a part of the firing pin is a shaft a portion of which has a ratchet grooves,
 - the ratchet fingers and the ratchet grooves being adapted to cooperate with each other to allow motion of the firing pin towards the primer material, but to prevent motion of the firing pin away from the primer material after ignition thereof.

33. The device according to claim 31, wherein the ignition means is an integral part of a preassembled gas generator module.

34. The device according to claim 1, wherein the device further comprising

(a) a housing,

(b) a first chamber within the housing, the first chamber containing a medication unit configured and dimensioned to store a volume of liquid medication to be injected, the medication unit having a first region and a second region that are in liquid communication with each other, the first region being deformable and the second region having an ejection outlet, and

(c) a second chamber within the housing, the second chamber containing a propellant,

the first chamber comprising two zones, a first zone containing the medication unit and a second zone which is in communication with the second chamber, so that upon ignition of the propellant in the second chamber gas generated thereby expands into the second zone of the first chamber, exerts pressure on and deforms the deformable first region of the medication unit and thereby causes ejection of the liquid medication through the ejection outlet.

35. The device according to claim 34, wherein the propellant is contained in a propellant chamber having a wall which has a zone of reduced thickness which upon ignition of the propellant bursts and thereby forms an opening of the wall when gas pressure within the propellant chamber exceeds a predetermined value.

36. The device according to claim 1, wherein the device further comprising

(a) a nozzle body, and

(b) a rigid housing,

the housing having a first open end adapted to receive and be connected with the nozzle body and a second closed end,

the interior of the housing defining a chamber which extends between the open end and the closed end of the housing, the chamber being adapted to receive,

a first deformable diaphragm which together with a cavity of the nozzle body forms a medication chamber suitable for receiving a predetermined amount of a medication, and

a second deformable diaphragm a portion of which extends around a portion of the first deformable diaphragm,

the second deformable diaphragm and the housing forming together a chamber for receiving a propellant as well as means for igniting the propellant, and

the nozzle body having at its outer end an orifice which is the outlet of a channel for ejecting the medication out of the chamber when a gas pressure generated by ignition of the propellant is applied to the second deformable diaphragm and thereby to the first deformable diaphragm.

37. The device according to claim 36, wherein the nozzle body and the housing are connected to form a single structural shell.

38. The device according to claim 36, further comprising venting means for venting of the space comprised between the first deformable diaphragm and the second deformable diaphragm.

39. The device according to claim 36, without the second deformable diaphragm.

40. The device according to claim 1, wherein the device further comprising

(a) a rigid medication container having a medication zone for receiving the liquid medication,

(b) a nozzle in fluidic communication with the medication zone, the nozzle having an outlet orifice,

(c) a propellant zone where the propellant is located within the device,

(d) a channel that fluidically connects the propellant zone with the medication zone, and

(e) piston means slidably arranged within the channel, so that upon ignition of the propellant gas pressure generated by combustion of the propellant causes displacement of the piston means which then exert pressure on the liquid medication and eject it through the outlet orifice of the nozzle.